User's Guide

EXTECH®
INSTRUMENTS
A FLIR COMPANY

pH/ORP Meter

SD Card real-time Datalogger

Model SDL100

Introduction

Congratulations on your purchase of the Extech SDL100 pH/ORP Meter, an SD Logger Series meter. This meter displays and stores pH (from 0 to 14.00pH) and ORP (±1999mV) readings. A temperature probe (supplied) can be inserted to the meter to provide automatic temperature compensation. Logged data readings are stored on an SD card for transfer to a PC. In addition, an RS232 port allows data streaming to a PC. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

Safety

International Safety Symbols

This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.

Meter Description

1. pH/ORP Sensor input BNC jack
2. Temperature probe input jack
3. pH/ORP Measurement reading on LCD Display
4. Temperature reading on LCD Display
5. HOLD and Backlight key
6. MAX-MIN key
7. SET and Clock key
8. PC interface jack
9. Reset button
10. Power Adaptor jack
11. SD card slot
12. ENTER and LOG key
13. Down arrow ▼ / Function key
14. Up arrow ▲ / CAL key
15. Power ON-OFF key

Notes:

Items 8, 9, and 10 are located behind the snap-off compartment cover on meter's right side.

Battery compartment, tilt stand, and tripod mount are located on the rear of the instrument

Getting Started

Power ON-OFF

- Press and hold the power button ⏻ for at least 1.5 seconds to power ON the meter.
- Press and hold the power button for 1.5 seconds to power OFF the meter.
- This meter is powered by six (6) 1.5VDC 'AA' batteries or by optional AC adaptor. If the meter will not switch ON please check that fresh batteries are installed in the rear battery compartment (refer to the battery replacement section later in this guide) or, in the case of the AC adaptor, check that the adaptor is connected correctly to the meter and to an AC source (refer to the AC Power Adaptor section later in this guide).

pH/ORP mV Measurements

Selecting pH or ORP modes of operation

Press and hold the FUNCTION button for at least 1.5 seconds; the display will begin to toggle between pH and ORP modes. Release the FUNCTION button when the desired mode is displayed.

pH Measurement Range

pH measurements are displayed in the range of 0.00 to 14.00 in the upper, larger digit display area of the meter's LCD. Measurements made outside of this range will yield dashes (- - -) on the meter's LCD. The Temperature value is shown below the pH reading on the LCD. Refer to the Measurement section for further information.

ORP mV Measurement Range

Ion-selective ORP (Oxidation Reduction Potential) measurements are displayed in the range of ±1999 mV (millivolts) in the upper, larger digit display area of the meter's LCD. Measurements outside of this range will yield dashes (- - -) on the meter's LCD.

Connecting the pH or ORP Electrode

The measurement electrode connects to the BNC socket on the top left of the meter. If a pH electrode is being connected to the meter for the first time, please perform a calibration as described in the Calibration section of this user guide.

Taking a pH or ORP Measurement

For pH measurements only, determine whether Manual or Automatic Temperature Compensation will be used and then set up as required.

Immerse the pH or ORP electrode into the solution under test and gently agitate the solution with the probe. When the meter's display has stabilized, note the reading (stabilization may require several seconds up to several minutes, depending on the solution).

When measurements have been completed, be sure to store the pH electrode in its protective cap with a pH4 moistened sponge.

Manual / Automatic Temperature Compensation (for pH measurements only)

Ph measurements are most accurate when the temperature of the solution under test is known and a temperature compensation factor is applied to the measurement. This is achieved using Manual or Automatic Temperature Compensation.

For Manual Temperature Compensation, the external temperature probe is not connected to the meter and the temperature of the solution under test is manually entered in the Setup Mode. The temperature entered is shown on the lower LCD line.

For Automatic Temperature Compensation, the external probe is connected to the meter and inserted into the solution to be tested. The measured temperature of the solution is displayed on the LCD.

Display Backlight

To turn the display backlight ON or OFF, press and hold the backlight button for at least 1.5 seconds.

Data Hold

To freeze a displayed reading on the LCD, momentarily press the HOLD button (the HOLD display icon will appear). To release the held reading, press the HOLD button again.

Max-Min Reading Record and Recall

For a given measurement session, this meter can record the highest (MAX) and the lowest (MIN) readings for later recall.

1. Press the MAX-MIN button momentarily to access this mode of operation (REC icon appears) The meter is now recording the MAX and MIN readings.
2. Press the MAX-MIN button again to view the current MAX readings (MAX icon appears). The readings on the display are now the highest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
3. Press the MAX-MIN button again to view the current MIN readings (MIN icon appears). The readings on the display are now the lowest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
4. To exit the MAX-MIN mode, press and hold the MAX-MIN button for at least 1.5 seconds The meter will beep, the REC-MAX-MIN icons will switch off, the MAX-MIN memory will clear, and the meter will return to the normal operating mode.

Setup Mode

Basic settings at a glance

To view the current configuration of the meter with regard to time, date, and datalogging sampling rate press the SET button momentarily. The meter will now display the configuration in quick succession. Repeat as necessary to observe all the information.

Accessing the Setup mode

1. Press and hold the SET button for at least 1.5 seconds to access the Setup menu.
2. Press the SET button momentarily to step through the available parameters. The parameter type is shown on the bottom of the LCD and the current selection for that type is shown above it.
3. When a parameter is displayed that is to be changed, use the arrow keys to change the setting. Press the ENTER button to confirm a change.
4. Press and hold the SET button for at least 1.5 seconds to exit the Setup mode. Note that the meter automatically switches out of the Setup mode if no key is pressed within 7 seconds.
5. The available Setup parameters are listed below. Additional detailed information is provided below this list:

dAtE	Set the clock (Year/Month/Date; Hours/Minutes/Seconds)
SP-t	Set the datalogger sampling rate (Hours/Minutes/Seconds)
PoFF	Automatic power-off management (Enable/disable the auto-power off function)
bEEP	Set the beeper sound ON/OFF
dEC	Set the numerical format; USA (decimal: 20.00) or European (comma: 20,00)
Sd F	Format the SD memory card
t-CF	Select the desired unit of measure for temperature C or F
t-SEt	Manual Temperature value

Setting the Clock Time

1. Access the **dAtE** parameter.
2. Use the arrow keys to change a value
3. Use the ENTER button to step through the selections
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).
5. The clock will keep accurate time even when the meter is switched off. However, if the battery expires the clock will have to be reset after fresh batteries are installed.

Setting the Datalogger Sampling Time (Rate)

1. Access the **SP-t** parameter.
2. The sampling rate can be set from ‘0’ seconds (manual log mode) up to 8 hours, 59 minutes, and 59 seconds.
3. Use the ENTER button to move through the Hours, Minutes, and Seconds digit groups and use the arrow keys to change the digit values.
4. Press the ENTER button to confirm the entry.
5. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Enabling/Disabling the Auto Power OFF Feature

1. Access the **PoFF** parameter.
2. Use the arrow buttons to select ON (enable) or OFF (disable). With the Auto Power OFF feature enabled, the meter will automatically switch OFF after 5 minutes of inactivity.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Beeper Sound ON or OFF

1. Access the **bEEP** parameter.
2. Use the arrow buttons to select ON (enable) or OFF (disable).
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Numerical Format (comma or decimal)

European and USA numerical formats differ. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**; The European format uses a comma, i.e. **20,00** to separate units from tenths. To change this setting:

1. Access the **dEC** parameter.
2. Use the arrow buttons to select USA or EUro.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

SD Card FORMATTING

1. Access the **Sd-F** parameter.
2. Use the arrow buttons to select YES to format the card (select NO to abort). Note that all data on the card will be lost if formatting is attempted.
3. Press ENTER to confirm selection.
4. Press ENTER again to re-confirm.
5. The meter will automatically return to the normal operating mode when formatting is complete. If not, press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode.

Set the Temperature Units of Measure (°C or °F)

1. Access the **t-CF** parameter.
2. Use the arrow keys to select °**C or** °**F**.
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Manual Temperature value

1. Access the **t-SEt** parameter.
2. Use the arrow keys to select the temperature of the solution under test in °**C or** °**F**.
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

System Reset

If the meter's keys become inoperable or if the display freezes the Reset button can be used to reset the instrument.

1. Use a paper clip or similar item to momentarily press the reset button located on the lower right side of the instrument under the snap-off compartment cover.
2. After pressing the Reset button, switch the instrument ON by pressing and holding the POWER key for at least 1.5 seconds. If using the power adaptor unplug the adaptor and then plug it back in again to power the meter.

pH Calibration procedure

pH Calibration Considerations

An ideal pH Electrode generates a linear mV output of +/- 59mV per pH with 0mV at a pH of 7.00. However, as time passes, the electrode ages and the mV output per pH is reduced. This is why calibration is so important. The Electrode must be calibrated with the companion meter as often as possible. In addition, the Electrode must be replaced when it has deteriorated or becomes defective. The meter must also be well maintained and calibrated for best results.

Required Equipment for pH Calibration

1. pH Electrode
2. pH buffer solutions

pH Calibration Procedure

1. Prepare buffer solutions for 7.00 pH and either 4.00 pH or 10.00 pH. Use the 4.00 pH and 7.00 pH solutions for measurements that are expected to be on the lower side of the scale. Use the 7.00 pH and 10.00 pH solutions for measurements that are expected to be on the higher side of the pH scale. Note that all three ranges can be calibrated for a full 3-point pH calibration if desired
2. Connect the pH Electrode to the meter
3. Switch the meter ON by pressing and holding the power button for at least 1.5 seconds. Ensure that the pH mode of operation is selected as described earlier in the Measurement section
4. Manually adjust the temperature compensation value (in Setup Mode) to match the buffer solution temperature or use the supplied temperature probe for automatic temperature compensation as discussed earlier (see the Temperature Compensation section for details)
5. Rinse the electrode with distilled water to remove residual solution
6. Immerse the pH Electrode and temperature Probe (if used) in the 7.00 pH buffer solution and agitate the solution gently with the Electrode
7. Allow the calibration to stabilize for 15 to 30 seconds and view the reading on the meter LCD
8. Press and hold the CAL button for at least 1.5 seconds until the CAL icon appears on the display and then release the CAL button
9. Use the arrow keys to scroll to the 7.00 pH display
10. Press the ENTER button to save the calibration data
11. Repeat steps number 5 through 10 for the 4.00 pH and 10.00 pH buffer solutions
12. Repeat the entire calibration to ensure optimal accuracy. Remember to rinse the Electrode before placing it into a new solution

Clearing pH Calibration data

1. From the normal operation mode, press and hold the CAL button for at least 1.5 seconds until the CAL icon appears on the display and then release the CAL button
2. Use the arrow keys to scroll to the CLR display
3. Press ENTER and all calibration data will be erased

Datalogging and PC Interface

Types of Data Recording

- **Manual Datalogging:** Manually log up to 99 readings onto an SD card via push-button press.
- **Automatic Datalogging:** Automatically log data onto an SD memory card where the number of data points is virtually limited only by the card size. Readings are logged at a rate specified by the user.
- **RS-232/USB:** The meter includes an RS-232/USB PC interface jack located on the lower right side of the meter under the snap-off compartment cover. The optional software kit (PN: 407001A) includes a cable and a software program for streaming data to a PC.

SD Card Information

- Insert an SD card (from 1G size up to 16G) into the SD card slot at the bottom of the meter. The card must be inserted with the front of the card (label side) facing toward the rear of the meter.
- If the SD card is being used for the first time it is recommended that the card be formatted and the logger's clock set to allow for accurate date/time stamping during datalogging sessions. Refer to the Setup Mode section for SD card formatting and time/date setting instructions.
- European and USA numerical formats differ. The data on the SD card can be formatted for either format. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**. The European format uses a comma, i.e. **20,00**. To change this setting, refer to the Setup Mode section.

Manual Datalogging

In the manual mode the user presses the LOG button to manually log a reading onto the SD card.

1. Set the sampling rate to '0' seconds as described in the Setup Mode section.
2. Press and hold the LOG button for at least 1.5 seconds and the DATALOGGER icon will appear on the LCD; the lower portion of the display will show "P N" (N = memory position number 1-99).
3. Momentarily press the LOG button to store a reading. The DATALOGGER icon will flash each time a data point is stored.
4. Use the ▲ and ▼ buttons to select one of the 99 data memory positions in which to record.
5. To exit the manual datalogging mode, press and hold the LOG button for at least 1.5 seconds. The DATALOGGER icon will switch off.

Automatic Datalogging

In automatic datalogging mode the meter takes and stores a reading at a user-specified sampling rate onto an SD memory card. The meter defaults to a sampling rate of one second. To change the sampling rate, refer to the Setup Mode section (the sampling rate cannot be '0' for automatic datalogging):

1. Select the sampling rate in the Setup Mode (refer to Setup Mode section) to a value other than zero.
2. Press and hold the LOG button for at least 1.5 seconds. The meter will flash the DATALOGGER icon at the selected sampling rate indicating that readings are now being automatically recorded to the SD card.
3. If a card is not inserted or if the card is defective, the meter will display SCAN SD indefinitely. In this case, switch the meter OFF and try again with a valid SD card.
4. Pause the datalogger by pressing the LOG button momentarily. The DATALOGGER icon will stop flashing and the sample rate will display for a short time. To resume logging simply press the LOG button again momentarily.
5. To terminate the datalogging session press and hold the LOG button for at least 1.5 seconds.
6. When an SD card is used for the first time a folder is created on the card and named **PHA01**. Up to 99 spreadsheet documents (each with 30,000 readings) can be stored in this folder.
7. When datalogging begins a new spreadsheet document named **PHA01001.xls** is created on the SD card in the PHA01 folder. The data recorded will be placed in the PHA01001.xls document until 30,000 readings are reached.
8. If the measurement session exceeds 30,000 readings, a new document will be created (PHA01002.xls) where another 30,000 readings can be stored. This method continues for up to 99 documents, after which another folder is created (PHA02) where another 99 spreadsheet documents can be stored. This process continues in this same fashion with folders PHA03 through PHA10 (last allowable folder).

SD Data Card to PC Data Transfer

1. Complete a datalogging session as detailed in above in the previous sections. Hint: For the first few tests, simply record a small amount of test data. This is to ensure that the datalogging process is well understood before committing to critical, large scale datalogging.
2. With the meter switched OFF, remove the SD Card.
3. Plug the SD Card directly into a PC SD card reader. If the PC does not have an SD card slot, use an SD card adaptor (available at most outlets where computer accessories are sold).
4. Power the PC and run a spreadsheet software program. Open the saved documents in the spreadsheet software program (see example spreadsheet data screen below).

Spreadsheet data example

	A	B	C	D	E	F	G
1	Position	Date	Time	CH1 Value	Ch1 Unit	Ch2 Value	Ch2 Unit
2	1	8/12/2011	13:00:00	7.00	pH	25.00	Degrees C
3	2	8/12/2011	13:00:01	7.00	pH	25.00	Degrees C
4	3	8/12/2011	13:00:02	7.00	pH	25.00	Degrees C
5	4	8/12/2011	13:00:03	7.00	pH	25.00	Degrees C
6	5	8/12/2011	13:00:04	7.00	pH	25.00	Degrees C
7	6	8/12/2011	13:00:05	7.00	pH	25.00	Degrees C
8	7	8/12/2011	13:00:06	7.00	pH	25.00	Degrees C
9	8	8/12/2011	13:00:07	7.00	pH	25.00	Degrees C
10	9	8/12/2011	13:00:08	7.00	pH	25.00	Degrees C
11	10	8/12/2011	13:00:09	7.00	pH	25.00	Degrees C
12	11	8/12/2011	13:00:10	7.00	pH	25.00	Degrees C
13	12	8/12/2011	13:00:11	7.00	pH	25.00	Degrees C

RS-232/USB PC Interface

The optional 407001A software kit (software and cable) allows streaming of data to a PC via the RS232 Output jack.

AC Power Adaptor

This meter is normally powered by six (6) 1.5V 'AA' batteries. An optional 9V power adaptor is available. When the adaptor is used, the meter is permanently powered and the power button will be disabled.

Battery Replacement and Disposal

When the low battery icon appears on the LCD, the batteries must be replaced. Several hours of accurate readings are still possible in this condition; however batteries should be replaced as soon as possible:

1. Remove the two (2) Phillips screws from the rear of the meter (directly above the top of the tilt stand).
2. Remove and safely place the battery compartment and screws where they will not be damaged or lost.
3. Replace the six (6) 1.5V 'AA' batteries, observing polarity.
4. Replace the battery compartment cover with the two (2) Phillips screws.

All EU users are legally bound by the battery ordinance to return all used batteries to collection points in your community or wherever batteries / accumulators are sold! Disposal in the household garbage is prohibited!

Specifications

General Specifications

Display	52 x 38mm (2 x 1.5") Backlit LCD
Status indicators	Out-of-range (----) and low battery
Measurement Units	pH, ORP, °C, and °F
Temperature probe	Thermistor (PN 850188)
Datalogger Sampling Rate	AUTO LOGGING: From 1 second to 8 hours 59 minutes and 59 seconds. Note that a one (1) second sampling rate can cause some data loss on slower computers
	Memory Card SD memory card; 1G to 16GB
Display update rate	Approx. 1 second.
Data Output	RS-232 / USB PC computer interface
Operating Temperature	0 to 50°C (32 to 122°F)
Operating Humidity	85% R.H. max.
Auto Power OFF	After 10 minutes of inactivity (can be disabled)
Power Supply	Six (6) 1.5 VDC batteries (optional 9V AC adaptor)
Power Consumption	Normal operation (backlight and datalogger OFF): approx. 14mAdc
	With backlight OFF and datalogging ON: approx. 37mAdc
	With backlight ON add approx. 12mAdc
Weight	365g (0.80 lbs.) meter only
Dimensions	Main instrument: 182 x 73 x 47.5mm (7.1 x 2.9 x 1.9")

Electrical Specifications (ambient temperature 23°C ± 5°C)

pH Electrode	All pH electrodes with a BNC connector are compatible	
Measurements	pH	
	mV	
Input Impedance	10^{12} ohm	
Temperature Compensation	Manual	0 to 100°C
	Automatic	(0 to 65°C)
pH Calibration	pH7, pH4, and pH10 (3-point calibration)	

Measurement	Range	Resolution	Accuracy
pH	0 to 14 pH	0.01 pH	± (0.02 pH + 2 d)*
mV (ORP)	-1999 mV to 1999 mV	1 mV	± (0.5% + 2d)
Temperature	0 to 65°C(32 to 149°F)	0.1°	±1C°/1.8°F
* pH accuracy based on freshly calibrated meter			

Copyright © 2011 Extech Instruments Corporation (a FLIR company)
All rights reserved including the right of reproduction in whole or in part in any form